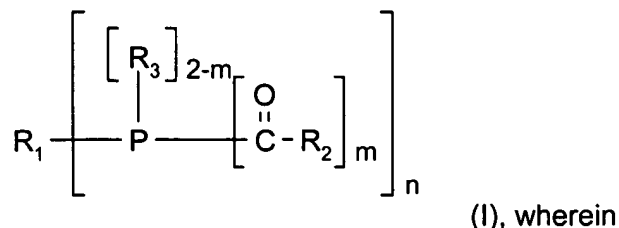


## Claims

1. **(currently amended)** A process for the preparation of acylphosphanes of formula I



**n** and **m** are each independently of the other 1 or 2;

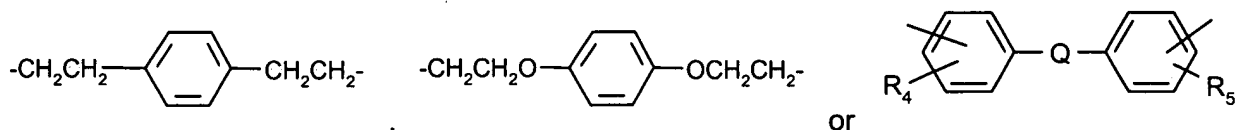
**R<sub>1</sub>**, if **n = 1**, is

C<sub>1</sub>-C<sub>18</sub>alkyl, C<sub>2</sub>-C<sub>18</sub>alkyl which is interrupted by one or several non-successive O atoms,  $[[;]]$  phenyl-C<sub>1</sub>-C<sub>4</sub>alkyl, C<sub>2</sub>-C<sub>8</sub>alkenyl, phenyl, naphthyl, biphenyl, C<sub>5</sub>-C<sub>12</sub>cycloalkyl or a 5- or 6-membered O-, S- or N-containing heterocyclic ring, the radicals phenyl, naphthyl, biphenyl, C<sub>5</sub>-C<sub>12</sub>cycloalkyl or the 5- or 6-membered O-, S- or N-containing heterocyclic ring being unsubstituted or substituted by one to five halogen, C<sub>1</sub>-C<sub>8</sub>alkyl, C<sub>1</sub>-C<sub>8</sub>alkylthio, C<sub>1</sub>-C<sub>8</sub>alkoxy and/or -N(R<sub>8</sub>)<sub>2</sub>;

**R<sub>1</sub>**, if **n = 2**, is

C<sub>1</sub>-C<sub>18</sub>alkylene, C<sub>2</sub>-C<sub>18</sub>alkylene which is interrupted by one or several non-successive O atoms; or R<sub>1</sub> is C<sub>1</sub>-C<sub>6</sub>alkylene which is substituted by C<sub>1</sub>-C<sub>4</sub>alkoxy, phenyl, C<sub>1</sub>-C<sub>4</sub>alkylphenyl, phenyl-C<sub>1</sub>-C<sub>4</sub>alkyl or C<sub>1</sub>-C<sub>6</sub>alkoxyphenyl; or R<sub>1</sub> is phenylene or xylylene, which radicals are unsubstituted or substituted by

one to three C<sub>1</sub>-C<sub>4</sub>alkyl and/or C<sub>1</sub>-C<sub>4</sub>alkoxy, or R<sub>1</sub> is a -CH<sub>2</sub>CH=CHCH<sub>2</sub>-,  $\text{-CH}_2\text{-C}\equiv\text{C-CH}_2\text{-}$ ,



group;

**R<sub>2</sub>** is C<sub>1</sub>-C<sub>18</sub>alkyl, C<sub>3</sub>-C<sub>12</sub>cycloalkyl, C<sub>2</sub>-C<sub>18</sub>alkenyl, phenyl-C<sub>1</sub>-C<sub>4</sub>alkyl, phenyl, naphthyl, biphenyl or a 5- or 6-membered O-, S- or N-containing heterocyclic ring, the radicals phenyl, naphthyl, biphenyl or the 5- or 6-membered O-, S- or N-containing heterocyclic ring being unsubstituted or substituted by one to five halogen, C<sub>1</sub>-C<sub>8</sub>alkyl, C<sub>1</sub>-C<sub>8</sub>alkoxy and/or C<sub>1</sub>-C<sub>8</sub>alkylthio;

**R<sub>3</sub>** is C<sub>1</sub>-C<sub>18</sub>alkyl, C<sub>2</sub>-C<sub>18</sub>alkyl which is interrupted by one or several non-successive O atoms or which is interrupted by -CO-, -COO-, -OCO-, -OCOO-, -CO-N(R<sub>9</sub>)-, -N(R<sub>9</sub>)-CO-, -N(R<sub>9</sub>)-CO-N(R<sub>9</sub>)-, -N(R<sub>9</sub>)-COO-; C<sub>1</sub>-C<sub>18</sub> alkyl substituted by -OR<sub>10</sub>, -OCO-R<sub>10</sub>, -COO-R<sub>10</sub>, -N(R<sub>9</sub>)-CO-R<sub>10</sub>, -CO-N(R<sub>9</sub>)-R<sub>10</sub>, -C(R<sub>11</sub>)=C(R<sub>12</sub>)-CO-OR<sub>10</sub> or -C(R<sub>11</sub>)=C(R<sub>12</sub>)-phenyl;

C<sub>2</sub>-C<sub>12</sub>alkenyl or C<sub>2</sub>-C<sub>12</sub>alkenyl which is interrupted by one or several non-successive O atoms; phenyl-C<sub>1</sub>-C<sub>4</sub>alkyl, phenyl, naphthyl, biphenyl, C<sub>5</sub>-C<sub>12</sub>cycloalkyl or a 5- or 6-membered O-, S- or N-containing heterocyclic ring, the radicals phenyl, naphthyl, biphenyl, C<sub>5</sub>-C<sub>12</sub>cycloalkyl or the 5- or 6-membered O-, S- or N-containing heterocyclic ring being unsubstituted or substituted by one to five halogen, C<sub>1</sub>-C<sub>8</sub>alkyl, C<sub>1</sub>-C<sub>8</sub>alkylthio C<sub>1</sub>-C<sub>8</sub>alkoxy and/or -N(R<sub>8</sub>)<sub>2</sub>; or R<sub>3</sub> is -CO-OR<sub>9</sub> or -CO-N(R<sub>9</sub>)<sub>2</sub>;

Q is a single bond, CR<sub>6</sub>R<sub>7</sub>, -O- or -S-;

R<sub>4</sub> and R<sub>5</sub> are each independently of the other hydrogen, C<sub>1</sub>-C<sub>4</sub>alkyl or C<sub>1</sub>-C<sub>4</sub>alkoxy;

R<sub>6</sub> and R<sub>7</sub> are each independently of the other hydrogen or C<sub>1</sub>-C<sub>4</sub>alkyl;

R<sub>8</sub> is C<sub>1</sub>-C<sub>18</sub> alkyl, C<sub>2</sub>-C<sub>18</sub> alkyl which is interrupted by one or several non-successive O-atoms; or -N(R<sub>8</sub>)<sub>2</sub> forms a 5- or 6-membered O-, S- or N-containing heterocyclic ring;

R<sub>9</sub> is hydrogen, C<sub>1</sub>-C<sub>18</sub>alkyl, C<sub>2</sub>-C<sub>18</sub>alkyl which is interrupted by one or several non-successive O atoms, C<sub>3</sub>-C<sub>12</sub>-cycloalkyl, C<sub>2</sub>-C<sub>18</sub>-alkenyl, phenyl-C<sub>1</sub>-C<sub>4</sub>-alkyl, phenyl, naphthyl, pyridyl, the radicals phenyl, naphthyl or pyridyl being unsubstituted or substituted by one to five C<sub>1</sub>-C<sub>8</sub>-alkyl, C<sub>1</sub>-C<sub>8</sub>-alkoxy, C<sub>1</sub>-C<sub>8</sub>-alkylthio and/or halogen; or -N(R<sub>9</sub>)<sub>2</sub> forms a 5- or 6-membered O-, S- or N-containing heterocyclic ring;

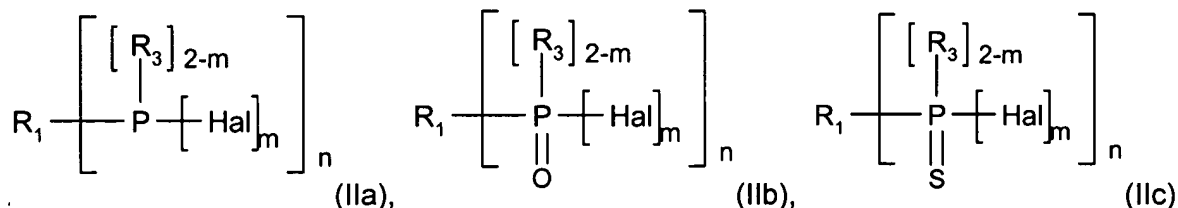
R<sub>10</sub> is C<sub>1</sub>-C<sub>18</sub>alkyl, C<sub>2</sub>-C<sub>18</sub>alkyl which is interrupted by one or several non-successive O-atoms, C<sub>3</sub>-C<sub>12</sub>-cycloalkyl, phenyl-C<sub>1</sub>-C<sub>4</sub>-alkyl, C<sub>2</sub>-C<sub>18</sub>-alkenyl, phenyl, naphthyl [[.]] or biphenyl [[:]] the radicals phenyl-C<sub>1</sub>-C<sub>4</sub>-alkyl, phenyl, naphthyl or biphenyl being unsubstituted or substituted by one to five C<sub>1</sub>-C<sub>8</sub>-alkyl, C<sub>1</sub>-C<sub>8</sub>-alkoxy, C<sub>1</sub>-C<sub>8</sub>-alkylthio and/or halogen;

R<sub>11</sub> is hydrogen or C<sub>1</sub>-C<sub>4</sub>-alkyl;

R<sub>12</sub> is hydrogen or C<sub>1</sub>-C<sub>4</sub>-alkyl;

by

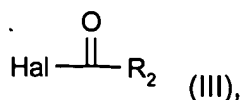
(1) reacting a phosphorous halide of formula IIa or a phosphorous halide oxide of formula IIb or a phosphorous halide sulfide of formula IIc



wherein R<sub>1</sub>, R<sub>3</sub>, n and m have the meaning cited above and Hal is F, Cl, Br or I;

with an alkali metal in a solvent (**metallation**) in the presence of a proton source (**reduction**);

(2) subsequent reaction with m acid halides of formula III



wherein  $\text{R}_2$ , Hal and m have the meaning cited above.

**2.(original)** A process according to claim 1, wherein in step (1) the metallation is carried out by reacting a compound of the formula IIa, IIb, or IIc with an alkali metal in a solvent, whereby a metallized phosphanide of the formula V



is formed together with cyclic phosphanes  $(\text{R}_1\text{P})_n$ ,  $n \geq 3$  as intermediates, wherein

Me is lithium, sodium or potassium or magnesium in combination with lithium, and

$\text{R}_1$  is as defined in claim 1; and

wherein the reduction is carried out by reacting the intermediate V and/or  $(\text{R}_1\text{P})_n$ ,  $n \geq 3$  with a proton source.

**3. (currently amended)** A process according to claim 2, wherein the alkali metal is sodium;

the proton source is selected from the group consisting of sterically hindered alcohols, trialkylamine hydrohalogenes, bisarylamines, malono nitrile, malonic acid esters, amidine hydrohalogene and carboxylic acids;

the solvent is one or more compounds selected from the group consisting of benzene, toluene, o-, m- or p-xylene, mesitylene, ethylbenzene, diphenylethane, 1,2,3,4-tetrahydronaphthalene (tetraline) **[[.]]** and isopropylbenzene (cumol); and mixtures thereof; and

the reaction temperature of step (1) is in the range from  $-20^\circ\text{C}$  to  $+160^\circ\text{C}$ .

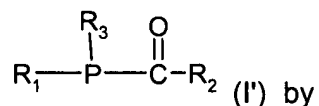
**4. (currently amended)** A process according to claim 3, wherein the sterically hindered alcohol is selected from the group consisting of secondary ~~or~~ and tertiary  $\text{C}_3$ - $\text{C}_{18}$  alcohols, ~~preferably of t-butanol, tert. amyl alcohol, 3-methyl-3-pentanol, 3-ethyl-3-pentanol, triphenylmethanol, 3,7-dimethyl-3-octanol, 2-methyl-1-phenyl-2-propanol, 2-methyl-4-phenyl-2-butanol, fenchyl alcohol, 2,4-dimethyl-3-pentanol, 1-dimethylamino-2-propanol or hexylene glycol.~~

5. **(currently amended)** A process according to ~~any one of claims 1-3, claim 1,~~ wherein the metallation is carried out in the presence of catalytic amounts of alkali or earth alkali hydroxides or of Na, K or Li alcoholates or of alcohols, ~~preferably sterically hindered alcoholates or alcohols.~~

6. **(currently amended)** A process according to ~~any one of claims 1-3, claim 1,~~ wherein the metallation and reduction step is carried out in the presence of an activator.

7. **(currently amended)** A process according to claim 6, wherein the activator is an amine selected from the group consisting of triethylamine, tributylamine, piperidine, morpholine, N-methylpiperidine, N-methyl morpholine ~~or a~~ and polyamines, ~~such as N,N,N',N'-tetramethylethylenediamine (TMEDA).~~

8. **(currently amended)** A process according to claim 1 for the preparation of **monoacylphosphanes** of the formula I'

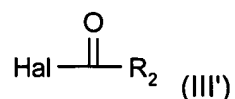


(1) reacting organic phosphorus halides of formula II'



with an alkali metal in a solvent in the presence of a proton source; and either

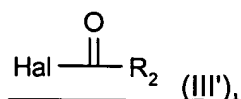
(2a) subsequent reaction with an acid halide of formula III'



followed by the reaction with an electrophilic compound  $\text{R}_3-\text{Hal}_1$  ~~or vice-versa,~~

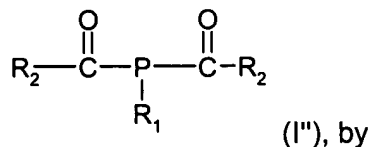
(2b) subsequent reaction with with an electrophilic compound  $\text{R}_3-\text{Hal}$

followed by the reaction with an acid halide of formula III'



wherein  $\text{R}_1$ ,  $\text{R}_2$  and  $\text{R}_3$  and Hal are as defined in claim 1.

9. **(currently amended)** A process according to claim 1 for the preparation of **symmetric bisacylphosphanes** of the formula I'' (~~compounds of the formula I with n=1 and m=2~~)

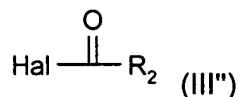


(1) reacting organic phosphorus halides of formula II''



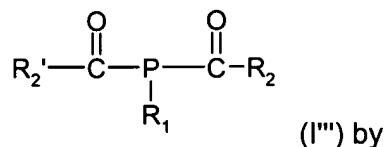
with an alkali metal in a solvent in the presence of a proton source;

(2) subsequent reaction with an acid halide of formula III''



wherein R<sub>1</sub> and R<sub>2</sub> and Hal are as defined in claim 1.

10. **(original)** A process according to claim 1 for the preparation of **unsymmetric bisacylphosphanes** of the formula I'''

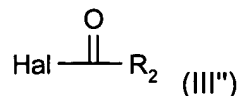


(1) reacting organic phosphorus halides of formula II''

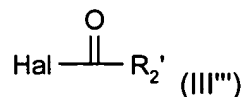


with an alkali metal in a solvent in the presence of a proton source;

(2) subsequent reaction with an acid halide of formula III''



(3) subsequent reaction with a second acid halide III'''



wherein

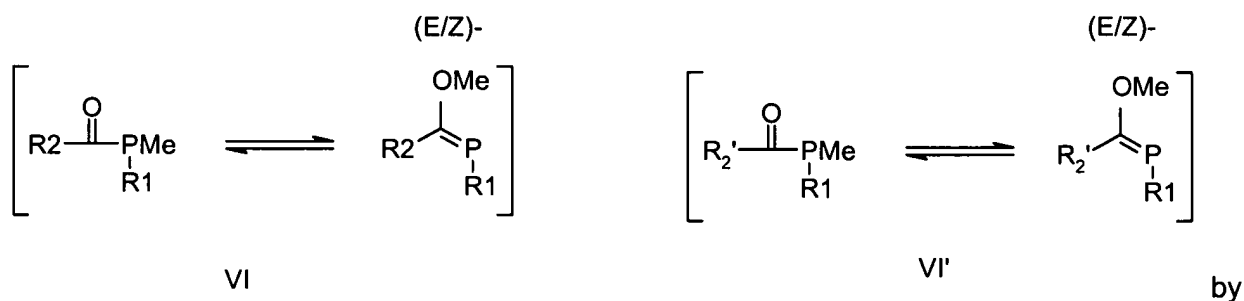
R<sub>1</sub> is as defined in claim 1 and

**R<sub>2</sub> and R<sub>2</sub>'** independently of one another are as defined in claim 1 under R<sub>2</sub> with the proviso that R<sub>2</sub> is not equal R<sub>2</sub>',

**Hal** is as defined in claim 1.

11. **(original)** A process according to claim 1, wherein step (1) is carried out by reacting diphosphanes of the formula (R<sub>1</sub>)<sub>2</sub>-P-P(R<sub>1</sub>)<sub>2</sub> or polyphosphanes of the formula [R<sub>1</sub>P]<sub>n</sub>, wherein R<sub>1</sub> is as defined above and n is ≥ 3, with an alkali metal in a solvent in the presence of a proton source; followed by the reaction with acid halides (III, III', III'', III''') and/or by reaction with electrophilic compounds R<sub>3</sub>-Hal.

12. **(currently amended)** A process according to claim 1 for the preparation of mono acylated phosphanes of the formula VI and VI'

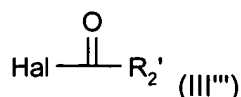
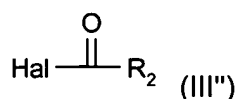


(1) reacting organic phosphorus halides of formula II''

R<sub>1</sub>-P(Hal)<sub>2</sub> (II'')

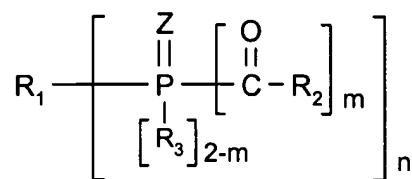
with an alkali metal in a solvent in the presence of a proton source;

(2) subsequent reaction with an acid halide of formula III'' or III'''



wherein R<sub>1</sub>, R<sub>2</sub> are as defined in claim 1, R<sub>2</sub>' is as defined in claim [[10]] 1 under R<sub>2</sub> with the proviso that R<sub>2</sub> is not equal R<sub>2</sub>' and Me is Li, Na, K or Mg in combination with Li.

13. **(currently amended)** A process according to claim 1, further comprising an additional step of oxidizing or reacting the acylphosphane of formula (I) with sulfur for the preparation of to prepare acylphosphane oxides and acylphosphane sulfides of formula IV



(IV), wherein

R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, n and m are as defined in claim 1, and Z is O or S, —

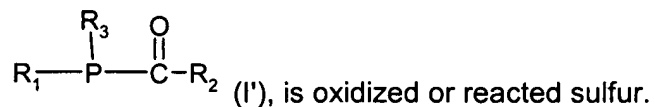
~~by oxidation or reaction with sulfur of the acylphosphane of formula I, I', I'' or I''' as defined in claims 1, 8, 9 and 10.~~

14. **(new)** A process according to claim 4, wherein the secondary and tertiary C<sub>3</sub>-C<sub>18</sub>alcohols are selected from the group consisting of t-butanol, t-amyl-alcohol, 3-methyl-3-pentanol, 3-ethyl-3-pentanol, triphenylmethanol, 3,7-dimethyl-3-octanol, 2-methyl-1-phenyl-2-propanol, 2-methyl-4-phenyl-2-butanol, fenchyl alcohol, 2,4-dimethyl-3-pentanol, 1-dimethylamino-2-propanol or hexylene glycol.

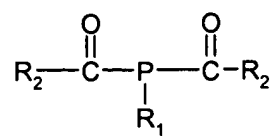
15. **(new)** A process according to claim 5, wherein metallation is carried out in the presence of catalytic amounts of Na, K or Li sterically hindered alcoholates or sterically hindered alcohols.

16. **(new)** A process according to claim 7, wherein the polyamine is N,N,N',N'-tetramethylethylenediamine.

17. **(new)** A process according to claim 13, wherein a monoacylphosphane of formula I'

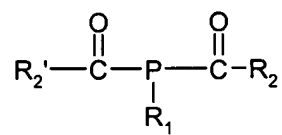


18. (new) A process according to claim 13, wherein a symmetric bisacylphosphane of formula I''



(I''), is oxidized or reacted sulfur.

19. (new) A process according to claim 13, wherein an unsymmetric bisacylphosphane of formula I'''



(I'''), is oxidized or reacted sulfur.